International Journal of Psychological Studies; Vol. 8, No. 3; 2016
ISSN 1918-7211 E-ISSN 1918-722X
Published by Canadian Center of Science and Education

Adaptive Malleability of Memory: Involuntary Memory in Executing Interpersonal Self-Deception

Hui Jing Lu[1]

[1] Department of Applied Social Sciences, The Hong Kong Polytechnic University, Hong Kong

Correspondence: Hui Jing Lu, Department of Applied Social Sciences, The Hong Kong Polytechnic University, Hong Kong. Tel: 852-276-6-5755. E-mail: huijing.lu@polyu.edu.hk

Received: May 30, 2016 Accepted: June 18, 2016 Online Published: June 23, 2016

doi:10.5539/ijps.v8n3p17 URL: http://dx.doi.org/10.5539/ijps.v8n3p17

This study was supported by an Early Career Scheme grant (project number: 25401214) from the Research Grant Council of the Hong Kong Special Administrative Region.

Abstract

Extending earlier work on the function of memory in executing self-deception, we hypothesized that involuntary conscious memory was temporarily lost or distorted to help the deceiver keep truthful information away from both self and others, whereas unconscious memory remained intact. In two experiments, participants were instructed to deceive a high- or low-status target by concealing previously studied words. Results showed that involuntary conscious memory but not voluntary conscious memory or unconscious memory of the participants differed between the two conditions of deception and nondeception, when the deceiving target was a high- compared to low-status person. This study pinpoints the involuntary conscious memory among the memory components in executing self-deception and supports the adaptive malleability of memory.

Keywords: self-deception, voluntary conscious memory, involuntary conscious memory

1. Introduction

An interpersonal approach to self-deception suggests that people place truthful information in the unconsciousness while consciously presenting false information to others and to the self (Trivers, 2000; von Hippel & Trivers, 2011). This approach differs from the intrapersonal approach that views self-deception as a personal self-enhancement trait (Paulhus, 1991; Paulhus & John, 1998), and from other approaches that view self-deception as rationalizing one's self-serving behavior without awareness (Chance, Norton, Gino, & Ariely, 2011; Sloman, Fernbach, & Hagmayer, 2010). The interpersonal approach views self-deception as a result of the "arms race" between deception and detection of deception, both of which occur in social interactive contexts representing a recurrent theme of human evolution. Interpersonal self-deception involves manipulation and transmission of information between consciousness and unconsciousness. Keeping false information in the consciousness for communication with others while keeping the truth in the unconsciousness helps achieve perfect deception by leaving no cues related to deliberate deception to evade detection. The human memory system is best suited for such information manipulation because of its adaptive malleability (Anderson & Schooler, 2000; Howe, 2011; Nairne, 2010), and thus may be used to achieve self-deception. The present study analyzes different memory components to explore the mechanisms by which memory manipulates information to achieve self-deception.

According to the interpersonal theory of self-deception (Trivers, 2000), false information is stored in the conscious mind so that invalid information is genuinely conveyed to others without exhibiting any cues of deception. Meanwhile, true information is stored in the unconsciousness, which may later be retrieved to benefit the self-deceiver (Lu & Chang, 2014). For example, in front of a high-status food seeker, a low-status food hider forgets completely or partially where he/she hides food. After the food seeker leaves, the food hider remembers where the food is. While deliberately deceiving others, a person may feel nervous or the pressure of being caught; thus, subtle signals such as reluctant long reaction time, high voice pitch, speech errors, and inhibited hand movements (DePaulo et al., 2003; Ekman & O'Sullivan, 1991; Vrij, Edward, Roberts, & Bull, 2000) may reveal the ongoing deception. By placing true information in the unconscious mind, self-deceivers are able to genuinely

convey false or null information without any risk of being detected. Therefore, self-deception, which evolved as an interpersonal strategy to countermine deception detection, should be sensitive to situations that have different probabilities of detection, with people more likely to self-deceive when sensing a higher likelihood of detection (Lu & Chang, 2011). The social status of the deceived is a variable that affects the likelihood of being detected, and thus the likelihood of self-deception being activated. High-status people have more resources and abilities to detect deception from low-status people who have fewer resources but are more motivated to cheat the high-status people (Cummins, 1999). Previous studies have shown that people are more likely to adopt a self-deception strategy when facing high- rather than low-status targets (Lu & Chang, 2014). Thus, in this study, the status of the target was used as a context for examining the application of the self-deception strategy. We speculated that the human memory system helps to achieve self-deception, particularly in the high-status context, by manipulating information between the consciousness and unconsciousness.

The memory system has been shown to serve survival goals and enhance fitness with its flexibility in information encoding, storage, and retrieval. Encoding preferences are oriented toward survival goals (Nairne, 2010; Nairne & Pandeirada, 2010) and future planning (Klein, Robertson, & Delton, 2010). Self-involved information and emotionally stimulating events are more effectively retained and are more resistant to decay compared with neutral and superficial information because they provide a meaningful reference for the future (Cahill & McGaugh, 1998; Symons & Johnson, 1997). Biased retrieval and reconstruction of past events are sometimes more adaptive than accurate recall (Howe, 2011). People recall past judgment in ways more consistent with the actual outcome than what they really thought before (Pieters, Baumgartner, & Bagozzi, 2006); such reconstruction of memory, known as hindsight bias, emphasizes the reality that guides future actions. Personal experiences are reconstructed in self-enhancing ways that help mold a positive self-image to benefit social relationships (Ross & Wilson, 2003). Feelings of temporal distance of personal events are biased to maintain harmonious kinship; because such kin favoritism in recall helps enhance inclusive fitness (Lu & Chang, 2009). Therefore, memory is subject to cost-benefit analysis (Anderson & Schooler, 2000), and information is memorized in both accurate and biased ways that serve adaptive purposes.

The memory structure of explicit/conscious and implicit/unconscious memory (Roediger, 1990; Schacter, 1987) is in line with the information placement system of self-deception proposed by Trivers (2000). Conscious memory involves subjective awareness in the recollection of experience, whereas unconscious memory involves retrieval without awareness, which affects behavior. In interpersonal self-deception (Trivers, 2000), false information is in the conscious, whereas true information is in the unconsciousness. When the motivation of deception ceases, the true information could return to the conscious. In a series of studies, Lu and Chang (2014) showed that conscious memory is temporarily impaired in self-deception whereby a person attempts to conceal information from others. In those studies, participants were either explicitly instructed or induced to deceive a high-status person. While interacting with the deceived target, participants remembered fewer studied items than they did later in another memory task without the deceived target. Thus, memory helps execute self-deception by concealing information through temporary conscious memory loss.

An additional question is what constitutes the impairment of conscious memory. Examining the components of conscious memory may help answer this question. Although conscious memory is typically a controlled and effortful process compared with Unconscious Memory (UM), which is automatic and effortless, it is argued that conscious memory also involves automatic processes (Mace, 2007; Richardson-Klavehn, Gardiner, & Java, 1996). Involuntary Conscious Memory (ICM) involves unintentional and spontaneous recollections that are self-reported without effortful recall. By contrast, Voluntary Conscious Memory (VCM) involves intentional and effortful recollections of experiences (Baddeley, Della Sala, Robbins, & Baddeley, 1996; Jacoby, 1991; Tulving, 2002). In widely adopted tasks of conscious memory, such as free recall and recognition, both VCM and ICM are assumed to be involved (Kvavilashvili & Mandler, 2004; Mace, 2006; Mandler, 1980; Schacter, Bowers, & Booker, 1989), although ICM has been overlooked and has received considerably less attention than VCM in research. Increasing studies of ICM have shown that spontaneous recollections in self-report occur in various contexts, including semantic (Kvavilashvili & Mandler, 2004; Mace, 2009; Richardson-Klavehn & Gardiner, 1996) and episodic memory tasks (Berntsen & Jacobsen, 2008; Mace, 2006; Rasmussen, Johannessen, & Berntsen, 2014). VCM and ICM may help explain how conscious memory is temporarily impaired in self-deception. Self-deceivers make an effort subjectively and voluntarily to collect true information to convey to the deceived because the self-deceivers are honest both to themselves and to the deceived. However, unconsciously and involuntarily, they keep true information from the deceived. Thus, the VCM of the self-deceivers should be similar to that of the nondeceivers, whereas ICM that automatically emerges into the consciousness without effortful recall may be reduced to help achieve self-deception.

The present study examined whether ICM was impaired in a context where self-deception was likely to occur. We adopted an intentional test and an incidental test to measure VCM and ICM, respectively. In the intentional test, the participants were explicitly instructed to complete word stems by recalling words that they had learned in the previous phase, and if they failed to recall they had to write down the first word that came to mind; in the incidental test, the participants were instructed to complete the word stems by writing down the words that first came to mind and then to check whether the words were learned in the previous phase. Data obtained from these tests were used to calculate and infer VCM and ICM (David & Brown, 2003; Richardson-Klavehn & Gardiner, 1996). We hypothesized that VCM would remain the same but ICM would be impaired when a person deceived a high-status person, compared with a nondeception condition. We also hypothesized that both VCM and ICM would be the same as those under the nondeception condition when a person deceived a low-status person, because there would be no memory loss in intentional deception.

2. Study 1

2.1 Participants

A total of 152 college students (71 men and 81 women, mean age = 20.50 years, SD = 1.03) were recruited to complete a verbal task and received a monetary reward for participation. They completed all tasks individually in a quiet room. They were randomly assigned to one of four groups: a VCM task involving deceiving high-status (VCM-H, n = 40) or low-status (VCM-L, n = 40) people and an ICM task involving deceiving high-status (ICM-H, n = 36) or low-status (ICM-L, n = 36) people. Participants were first informed about which words to use for deceiving and which not to. This was a 2 (between-subject, status of the deceived: high vs. low) × 2 (within-subject, information: deception vs. nondeception) mixed-model design, with dependent variables being percentages of words that fall in the categories of VCM, ICM, and UM.

2.2 Procedure

Study Phase. The participants were asked to memorize 30 Chinese two-character words of medium usage frequency. They were told that they had to deceive on half the words and tell the truth on the remaining half in a later deception task in which a target person would ask what words they had learnt in the study phase. Each word was presented on a computer screen for 7s, and during the last 2s, an instruction was presented next to the word, indicating deception or not. The deception and nondeception words were presented randomly. The participants under the high-status condition were informed that their task was to deceive a teacher in the later deception task by concealing words that would have the instruction "deceive the teacher". By contrast, the participants under the low-status condition were informed that their task was to deceive a student in the later deception task by concealing words that have the instruction "deceive the student". The nondeception words had the instruction "do not deceive" under both high- and low-status conditions. After the study phase, to avoid rehearsal and recency effect, participants completed a filler task of shape identification on the computer for 5 minutes. Circles or squares randomly appeared one by one on different areas of the computer screen, and participants' task was to identify the shape by pressing one of two different keys on the keyboard. After the filler task, participants were told to complete a test before they proceed to the task in which they had to interact with the target person by not divulging deception words but telling the truth about the non-deception words.

Intentional Test. The participants in the VCM-H and VCM-L groups participated in this test. They were given a test sheet with 30 Chinese characters that had two blanks next to them. These characters were the first character of the two-character words learned by the participants in the study phase. The participants were asked to use the first character as a cue to recall the word they had learned and write it down in the first blank. If they were unable to recall the word learned, in the second blank, they had to write down a two-character word that first came to their mind beginning with the given character. The number of learned words that were filled only in the first blanks was considered as VCM because the participants were able to actively and explicitly recall those words. The total number of learned words that were filled in both the blanks was considered as Total Memory, which involved both consciously self-reported words (VCM) and those that could not be consciously retrieved (1-VCM) but were still reported through UM. Therefore, Total Memory = VCM + UM*(1−VCM). Thus, UM was calculated using the following formula: UM = (Total Memory−VCM)/(1−VCM). The calculation of UM is similar to that of implicit memory from word-stem completion tasks (Roediger, 1990).

Incidental Test. The test sheets received by the participants in the ICM-H and ICM-L groups were the same as those in the intentional test, except for the task instruction. In the first blank, the participants were instructed to write down the two-character words as quickly as they could by using the given character as the first character of a word. They were instructed to write down the words that first came to mind. Their performances were timed to encourage speed and avoid intentional recall. On completion of the task, the participants were asked to check

whether the words were learned in the study phase. If they confirmed that a word was learned, they had to write down another two-character word beginning with the given character in the second blank. The number of learned words filled in the first blank and later identified by the participants as learned words was considered as ICM because they automatically came to the participant's mind and could be consciously identified.

After either test, participants were debriefed and told that they did not have to perform the deception task depicted in the study phase. The purpose of letting participants anticipate a deception task was to motivate them to have a mindset of deceiving a high- or low-status target.

2.3 Results and Discussion

Table 1 shows the descriptive statistics for VCM, ICM, and UM. For both VCM and UM, a 2 (high- vs. low-status target) × 2 (deception vs. nondeception) mixed-model analysis of variance showed neither a main effect nor interaction. By contrast, for ICM, an interaction effect was observed between target and deception (F (1, 70) = 5.19, MSE = 0.018, p = .026, η^2 = .07). Under the high-status target condition, the ICM of deception words (M = .21, SD = .14) was worse than that of nondeception words (M = .32, SD = .17; t (35) = -3.87, p < .001), whereas under the low-status target condition, the ICM of deception (M = .28, SD = .15) and nondeception words (M = .29, SD = .19) was similarly remembered (t (35) = −.16, p = .88). The results suggested that when the target was a high-status person, the participants involuntarily responded with less information that involved deception than that which involved nondeception, even though voluntarily and intentionally, they responded with equal amounts of information for both deception and nondeception. The lack of involuntary recall of information involving deception of a high-status person helped in the execution of self-deception because, regarding information placement, self-deception requires consciously attempting to offer others true information while unconsciously attempting to hold back information; therefore, involuntarily offering less information to others helps achieve that objective.

Table 1. Mean and standard deviation of memory as functions of target and deception in study 1

	High-Status Target		Low-Status Target	
	Deception	Non-deception	Deception	Non-deception
Intentional Test				
Voluntary Conscious Memory	.36 (.16)	.35 (.16)	.36 (.18)	.38 (.18)
Unconscious Memory	.13 (.08)	.14 (.13)	.14 (.17)	.14 (.18)
Incidental Test				
Involuntary Conscious Memory	.21 (.14)	.32 (.17)	.28 (.15)	.29 (.19)

Note. The numbers of Voluntary Conscious Memory and Involuntary Conscious Memory indicate proportion of words provided by participants out of total number of words learnt in the study phase.

3. Study 2

In Study 1, because the participants already knew whom to deceive during the study phase, it was unclear whether the difference in memory between the high- and low-status conditions occurred during the information encoding stage or the information retrieval stage. Study 2 featured an identical encoding stage between the two conditions and restricted the difference only in the retrieval stage. Moreover, we temporarily manipulated the status difference between the participants and the hypothetical target.

3.1 Participants

A total of 120 participants (60 men and 60 women, *mean age* = 20.54 years, SD = 1.26) were recruited. They were randomly assigned to one of the four conditions, as in Study 1.

3.2 Procedure

The procedure of the study phase and obtaining VCM, ICM, and UM was identical to that in Study 1, except that in the study phase, the participants were notified about which words were to be used for deception but no specific detail of the deception target was mentioned, and that after the study phase, the filler task was replaced by the status manipulation task. In the status manipulation, the participants were informed that they would be

paired with a deception target and during interaction with the target, they should not divulge words meant to deceive but to tell the truth about the words meant not to deceive. To generate a status difference, the power between participants and hypothetical targets was differentiated using an ostensible evaluation task. The participants first completed the Balanced Inventory of Desirable Response as a "personality" test, after which they were asked to draw lots to determine whether they would evaluate others or be evaluated by others. The lots were manipulated by the experimenter so that the participants in the high-status target group always drew "be evaluated", whereas the participants in the low-status target group always drew "evaluate others". The participants in the high-status target group were told that another person would anonymously evaluate their responses to the personality test for competency and responsibility, and those in the low-status target group were told that they were going to anonymously evaluate the responses of other people. The power of evaluating others and the inferiority of being evaluated has been shown to generate perceptions of a status-based hierarchy (Anderson & Berdahl, 2002; Hall, Carter, & Horgan, 2001). No actual evaluation task was conducted, and the participants were debriefed after the memory test.

The Balanced Inventory of Desirable Response (Paulhus, 1991) is widely adopted to measure self-deception and impression management by using two subscales. This instrument was used as the ostensible "personality" test as well as a measure of self-deceptive traits. Sample items of the self-deception subscale includes "I am very confident in my judgment" and "I am a completely rational person", whereas those of the impression management subscale includes "I never cover up my mistakes" and "When I hear people talking privately, I avoid listening". The participants rated on a 7-point rating scale from "not true at all" to "completely true", and higher scores indicated more self-deceptive or a tendency of a greater desire to impress others. The reliability of the self-deception and impression management scales in this study were .74 and .85, respectively.

3.3 Results and Discussion

For both VCM and UM (Table 2), a 2 (high- vs. low status-target) × 2 (deception vs. non-deception) mixed-model analysis of variance showed neither a main effect nor interaction. By contrast, for ICM, an interaction effect was observed between target and deception (F (1, 58) = 5.37, MSE = .007, p = .024, η^2 = .09). A similar interaction effect was observed after controlling for self-deception in an analysis of covariance test, using self-deception scores as covariate (F (1, 57) = 5.43, MSE = .007, p = .023, η^2 = .09). Under the high-status target condition, the ICM of deception words (M = .18, SD = .12) was worse than that of nondeception words (M = .24, SD = .12; t (29) = −4.06, p < .001), whereas under the low-status target condition, the ICM of deception (M = .25, SD = .21) and nondeception (M = .24, SD = .18) words was similar (t (29) = .26, p = .80). These results were similar to those of Study 1, suggesting that the participants consciously recalled less deception words than non-deception words for high-status targets because of the impairment of ICM.

Table 2. Mean and standard deviation of memory as functions of target and deception in Study 2

	High-Status Target		Low-Status Target	
	Deception	Non-deception	Deception	Non-deception
Intentional Test				
Voluntary Conscious Memory	.35 (.19)	.36 (.21)	.42 (.18)	.40 (.17)
Unconscious Memory	.16 (.16)	.16 (.15)	.19 (.15)	.18 (.10)
Incidental Test				
Involuntary Conscious Memory	.18 (.12)	.24 (.12)	.25 (.21)	.24 (.18)

Note. The numbers of Voluntary Conscious Memory and Involuntary Conscious Memory indicate proportion of words provided by participants out of total number of words learnt in the study phase.

Self-deception measure from the personality instrument was unrelated to any memory indicator (Table 3), suggesting that the intrapersonal trait of self-deception has no effect on memory in executing interpersonal self-deception. VCM of nondeception information was positively correlated to impression management (r = .37, p < .01), suggesting that people with a greater desire to impress others have superior voluntary memory of information to share.

Table 3. Correlation between memory and self-deception and impression management (n = 60)

	Information to Deceive			Information to Not Deceive		
	VCM	UM	ICM	VCM	UM	ICM
Self-deception	-.08	-.03	-.07	.20	.15	-.08
Impression Management	.14	-.21	.09	.37**	.23	.12

VCM = Voluntary Conscious Memory; UM = Unconscious Memory; ICM = Involuntary Conscious Memory; ** $p < .01$, numbers not marked with * indicate insignificant correlation.

4. General Discussion

A previous study showed that the human memory system facilitates the execution of interpersonal self-deception by temporarily impairing conscious memory to allow null or false information to be conveyed to others without detection (Lu & Chang, 2014). However, the study did not address how conscious memory is impaired when a person attempts to honestly convey true information. The present study answered this question by examining different components of conscious memory. Based on the process dissociation procedure measuring conscious memory and UM (Jacoby, 1991), a revised method helped identify two components of conscious memory: VCM and ICM (David & Brown, 2003; Richardson-Klavehn & Gardiner, 1996). This study distinguished between VCM and ICM when participants self-deceived to deceive a high-status target. In cases where participants perceived a high-status target of deception and thus implied a high probability of detection, the participants voluntarily conveyed a similar amount of deception words and non-deception words, whereas they involuntarily offered fewer deception words than non-deception words. These differences in the relationship between VCM and ICM corresponding to deception and nondeception were not observed when the probability of detection was low. These results suggested that temporary memory loss when a person self-deceives is attributed to the impairment of ICM, the memory that involuntarily emerges into a person's consciousness.

The amount of information that enters the consciousness is determined by the unconsciousness. We hypothesized that an underlying mechanism of cost-benefit analysis may help trigger the self-deception strategy and determine ICM. The unconscious mechanism of cost-benefit analysis is complex and constitutes the optimal strategy. The mechanism helps a person form a fight-or-flight decision when faced with a rival through holistic consideration of information including strength and limitations of the person and the rival, the probability of winning, chances of forming an alliance, and methods of distracting the rival to another rival (Dawkins, 1976; Trivers, 1985); however, the optimal solution cannot be reached through conscious consideration (Dijksterhuis, Bos, Nordgren, & van Baaren, 2006) because conscious, controlled, and effortful thinking works in sequential ways that accommodate only a limited amount of information, whereas unconscious, automatic, and effortless thinking works in parallel ways that allow abundant information to be considered simultaneously. The unconscious mechanism also helps determine somatic effort in pursuing reward, with more effort being paid to obtain higher reward, particularly when the task demand is high (Bijleveld, Custers, & Aarts, 2012). In this study, the unconscious mechanism senses the context where a person is motivated to deceive, and responds with the self-deception strategy if it senses that the probability of successful deception is low. The trigger of self-deception prevents information from automatically emerging into the conscious mind.

The self-deception strategy in response to dynamic situations of deception is independent of the self-deception trait; Study 2 showed no correlation between the amounts of ICM and scores of the self-deceptive enhancement scale. Reduced ICM of deception information compared with nondeception information represents the strategy of interpersonal self-deception, and the strategy was triggered by the interpersonal context of deception and deception detection. By contrast, scores of the self-deceptive enhancement scale represent intrapersonal self-deception, which is defined as the tendency of having an overly positive self-image that does not directly involve anyone else. Inter- and intrapersonal self-deception may have developed at different times in human evolution. Interpersonal deception was the evolutionary origin of self-deception for countermining deception detection, and later, the interpersonal strategy was borrowed for intrapersonal processes including enhancing the self and maintaining well-being (von Hippel & Trivers, 2011). The null correlation between inter- and intrapersonal deceptions in Study 2 could have been caused by the distinct evolutionary functions of the two types of self-deception. Interpersonal deception should be more delicate and universally used in an unconscious and automatic manner, whereas intrapersonal deception is developed as a stable trait that is not affected by interpersonal deceptive contexts.

This study had several limitations. First, the activation of self-deception cannot be verified. Because self-deception means that people are unaware of the ongoing deception, it is difficult to verify self-deception through self-reports or observation by others. Because self-deception is sensitive to situations indicating the probability of detection (Lu, 2012; Lu & Chang, 2011), we designed situations where the deceived targets were perceived as proficient in deception detection. The results ensured that, in contexts where self-deception was assumed to be triggered, the participants showed memory performance in ways that facilitated self-deception. Second, UM in this study was not directly measured, but estimated using the memory test procedure and estimation formula. Because unconsciousness information is difficult to probe, UM was operationalized as self-reported information that cannot be recognized by the participants themselves. Although consistent with previous studies (David & Brown, 2003), the estimated scores were relatively low, which is incongruent with the theoretical frame that a substantial amount of information is stored in the unconsciousness (Greenwald, 1988). Because of limitations in the methodology of measuring unconsciousness information, currently we can only use the estimated scores for UM. Third, participants' memory of which words to be revealed and which words to be concealed was not measured in the study. Nonetheless, occurrence of self-deception does not require accurate source memory of words. Forth, we studied only how participants self-deceived to conceal information, whereas deception and self-deception also occur through other methods such as distortion and falsification (Loftus, 1996). Additional studies can examine how memories are unconsciously distorted to achieve deception. Moreover, personal experience is a major source of deception; thus, future studies can also examine the role of the involuntary memory of experiences and future planning in executing self-deception.

References

Anderson, C., & Berdahl, J. L. (2002). The experience of power: Examining the effects of power on approach and inhibition tendencies. *Journal of Personality and Social Psychology*, *83*, 1362-1377. http://dx.doi.org/10.1037/0022-3514.83.6.1362

Anderson, J. R., & Schooler, L. J. (2000). The adaptive nature of memory. In F. I. M. Craik, & E. Tulving (Eds.), *Oxford handbook of memory* (pp. 557-570). England: Oxford University Press.

Baddeley, A., Della Sala, S., Robbins, T. W., & Baddeley, A. (1996). Working memory and executive control [and discussion]. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *351*, 1397-1404. http://dx.doi.org/10.1098/rstb.1996.0123

Berntsen, D., & Jacobsen, A. S. (2008). Involuntary (spontaneous) mental time travel into the past and future. *Consciousness and Cognition*, *17*, 1093-1104. http://dx.doi.org/10.1016/j.concog.2008.03.001

Bijleveld, E., Custers, R., & Aarts, H. (2012). Adaptive reward pursuit: How effort requirements affect unconscious reward responses and conscious reward decisions. *Journal of Experimental Psychology: General*, *141*, 728-742. http://dx.doi.org/10.1037/a0027615

Cahill, L., & McGaugh, J. L. (1998). Mechanisms of emotional arousal and lasting declarative memory. *Trends in Neurosciences*, *21*, 294-299. http://dx.doi.org/10.1016/S0166-2236(97)01214-9

Chance, Z., Norton, M. I., Gino, F., & Ariely, D. (2011). Temporal view of the costs and benefits of self-deception. *Proceedings of the National Academy of Sciences*, *108*, 15655-15659. http://dx.doi.org/10.1073/pnas.1010658108

Cummins, D. D. (1999). Cheater detection is modified by social rank: The impact of dominance on the evolution of cognitive functions. *Evolution and Human Behavior*, *20*, 229-248. http://dx.doi.org/10.1016/S1090-5138(99)00008-2

David, D., & Brown, R. (2003). The impact of different directed forgetting instructions on implicit and explicit memory: New evidence from a modified process dissociation procedure. *Quarterly Journal of Experimental Psychology: Section A*, *56*, 211-231. http://dx.doi.org/10.1080/02724980244000431

Dawkins, R. (1976). *The Selfish Gene*. New York City: Oxford University Press.

DePaulo, B. M., Lindsay, J. J., Malone, B. E., Muhlenbruck, L., Charlton, K., & Cooper, H. (2003). Cues to deception. *Psychological Bulletin*, *129*, 74-118. http://dx.doi.org/10.1037/0033-2909.129.1.74

Dijksterhuis, A., Bos, M. W., Nordgren, L. F., & van Baaren, R. B. (2006). On making the right choice: The deliberation-without-attention effect. *Science*, *311*, 1005-1007. http://dx.doi.org/10.1126/science.1121629

Ekman, P., & O'Sullivan, M. (1991). Who can catch a liar? *American Psychologist*, *46*, 913-920. http://dx.doi.org/10.1037/0003-066X.46.9.913

Greenwald, A. G. (1988). Self-knowledge and self-deception. In J. S. Lockard, & D. L. Paulhus (Eds.), *Self-deception: An adaptive mechanism* (pp. 111-129). Englewood Cliffs, NJ: Prentice-Hall.

Hall, J. A., Carter, J. D., & Horgan, T. G. (2001). Status roles and recall of nonverbal cues. *Journal of Nonverbal Behavior*, *25*, 79-100. http://dx.doi.org/10.1023/A:1010797627793

Howe, M. L. (2011). The adaptive nature of memory and its illusions. *Current Directions in Psychological Science*, *20*, 312-315. http://dx.doi.org/10.1177/0963721411416571

Jacoby, L. L. (1991). A process dissociation framework: Separating automatic from intentional uses of memory. *Journal of Memory & Language*, *30*, 513-541. http://dx.doi.org/10.1016/0749-596X(91)90025-F

Klein, S. B., Robertson, T. E., & Delton, A. W. (2010). Facing the future: Memory as an evolved system for planning future acts. *Memory & Cognition*, *38*, 13-22. http://dx.doi.org/10.3758/MC.38.1.13

Kvavilashvili, L., & Mandler, G. (2004). Out of one's mind: A study of involuntary semantic memories. *Cognitive Psychology*, *48*, 47-94. http://dx.doi.org/10.1016/S0010-0285(03)00115-4

Loftus, E. F. (1996). Memory distortion and false memory creation. *Journal of the American Academy of Psychiatry and the Law Online*, *24*, 281-295.

Lu, H. J. (2012). Self-deception: Deceiving yourself to better deceive others. *Acta Psychologica Sinica*, *44*, 1265-1278. http://dx.doi.org/10.3724/SP.J.1041.2012.01265

Lu, H. J., & Chang, L. (2009). Kinship effect on subjective temporal distance of autobiographical memory. *Personality and Individual Differences*, *47*, 595-598. http://dx.doi.org/10.1016/j.paid.2009.05.014

Lu, H. J., & Chang, L. (2011). Self-deceive to countermine detection. *Behavioral and Brain Sciences*, *34*, 33. http://dx.doi.org/10.1017/S0140525X10002529

Lu, H. J., & Chang, L. (2014). Deceiving yourself to better deceive high-status compared to equal-status others. *Evolutionary Psychology*, *12*, 635-654. http://dx.doi.org/10.1177/147470491401200310

Mace, J. H. (2006). Episodic remembering creates access to involuntary conscious memory: Demonstrating involuntary recall on a voluntary recall task. *Memory*, *14*, 917-924. http://dx.doi.org/10.1080/09658210600759766

Mace, J. H. (2007). Involuntary memory: Concept and theory. In J. H. Mace (Ed.), *Involuntary memory* (pp. 11-29). Malden, MA: Blackwell. http://dx.doi.org/10.1002/9780470774069

Mace, J. H. (2009). Involuntary conscious memory facilitates cued recall performance: Further evidence that chaining occurs during voluntary recall. *The American Journal of Psychology*, *122*, 371-381.

Mandler, G. (1980). Recognizing: The judgment of previous occurrence. *Psychological Review*, *87*, 252-271. http://dx.doi.org/10.1037/0033-295X.87.3.252

Nairne, J. S. (2010). Adaptive memory: Evolutionary constraints on remembering. In B. H. Ross (Ed.), *Psychology of Learning and Motivation: Advances in Research and Theory* (Vol. 53, pp. 1-32). London, UK: Academic Press. http://dx.doi.org/10.1016/S0079-7421(10)53001-9

Nairne, J. S., & Pandeirada, J. N. (2010). Adaptive memory: Ancestral priorities and the mnemonic value of survival processing. *Cognitive Psychology*, *61*, 1-22. http://dx.doi.org/10.1016/j.cogpsych.2010.01.005

Paulhus, D. L. (1991). Measurement and control of response bias. In J. P. Robinson, P. R. Shaver, & L. S. Wrightsman (Eds.), *Measures of personality and social psychological attitudes* (pp. 17-59). New York: Academic Press. http://dx.doi.org/10.1016/B978-0-12-590241-0.50006-X

Paulhus, D. L., & John, O. P. (1998). Egoistic and moralistic biases in self-perception: The interplay of self-deceptive styles with basic traits and motives. *Journal of Personality*, *66*, 1025-1060. http://dx.doi.org/10.1111/1467-6494.00041

Pieters, R., Baumgartner, H., & Bagozzi, R. (2006). Biased memory for prior decision making: Evidence from a longitudinal field study. *Organizational Behavior and Human Decision Processes*, *99*, 34-48. http://dx.doi.org/10.1016/j.obhdp.2005.05.004

Rasmussen, A. S., Johannessen, K. B., & Berntsen, D. (2014). Ways of sampling voluntary and involuntary autobiographical memories in daily life. *Consciousness and cognition*, *30*, 156-168. http://dx.doi.org/10.1016/j.concog.2014.09.008

Richardson-Klavehn, A., & Gardiner, J. M. (1996). Cross-modality priming in stem completion reflects conscious memory, but not voluntary memory. *Psychonomic Bulletin & Review*, *3*, 238-244. http://dx.doi.org/10.3758/BF03212425

Richardson-Klavehn, A., Gardiner, J. M., & Java, R. I. (1996). Memory: Task dissociations, process dissociations and dissociations of consciousness. In G. Underwood (Ed.), *Implicit Cognition* (pp. 85-158). Oxford: Oxford University Press.

Roediger, H. L. (1990). Implicit memory: Retention without remembering. *American Psychologist*, *45*, 1043-1056. http://dx.doi.org/10.1037/0003-066X.45.9.1043

Ross, M., & Wilson, A. E. (2003). Autobiographical memory and conceptions of the self: Getting better all the time. *Current Directions in Psychological Science*, *12*, 66-69. http://dx.doi.org/10.1111/1467-8721.01228

Schacter, D. L. (1987). Implicit memory: History and current status. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *3*, 501-518. http://dx.doi.org/10.1037/0278-7393.13.3.501

Schacter, D. L., Bowers, J., & Booker, J. (1989). Intention, awareness, and implicit memory: The retrieval intentionality criterion. In S. Lewandowsky, J. C. Dunn, & K. Kirsner (Eds.), *Implicit memory: Theoretical issues* (pp. 47-65). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Sloman, S. A., Fernbach, P. M., & Hagmayer, Y. (2010). Self-deception requires vagueness. *Cognition*, *115*, 268-281. http://dx.doi.org/10.1016/j.cognition.2009.12.017

Symons, C. S., & Johnson, B. T. (1997). The self-reference effect in memory: A meta-analysis. *Psychological Bulletin*, *121*, 371-394. http://dx.doi.org/10.1037/0033-2909.121.3.371

Trivers, R. (1985). Deceit and self-deception. In *Social Evolution* (pp. 395-420). Menlo Park, CA: Benjamin/Cummings.

Trivers, R. L. (2000). The elements of a scientific theory of self-deception. *Annals of the New York Academy of Sciences*, *907*, 114-131. http://dx.doi.org/10.1111/j.1749-6632.2000.tb06619.x

Tulving, E. (2002). Episodic memory: From mind to brain. *Annual review of psychology*, *53*, 1-25. http://dx.doi.org/10.1146/annurev.psych.53.100901.135114

von Hippel, W., & Trivers, R. (2011). The evolution and psychology of self-deception. *Behavioral and Brain Sciences*, *34*, 1-16. http://dx.doi.org/10.1017/S0140525X10001354

Vrij, A., Edward, K., Roberts, K. P., & Bull, R. (2000). Detecting deceit via analysis of verbal and nonverbal behavior. *Journal of Nonverbal Behavior*, *24*, 239-263. http://dx.doi.org/10.1023/A:1006610329284